

**CLAIMS**

What is claimed is:

1 1. A method of coupling one or more surface-emitting lasers to one or more edge-receiving  
2 optical devices, the method comprising the steps of:

3 mounting the one or more surface-emitting lasers to an optical bench substrate;

4 mounting the one or more edge-receiving optical devices to the optical bench substrate;

5 and

6 emitting output signals from the one or more surface-emitting lasers to the one or more  
7 edge-receiving optical devices.

1 2. The method of claim 1, wherein the one or more surface-emitting lasers are fabricated on  
2 a laser substrate; and wherein the step of mounting the one or more surface-emitting lasers  
3 comprises the step of mounting the laser substrate to a slot on the optical bench substrate so that  
4 the output signals emit directly into the one or more edge-receiving optical devices.

1 3. The method of claim 2, wherein the step of mounting the laser substrate comprises the  
2 step of mounting an edge of the laser substrate to the slot so as to optically couple the one or  
3 more surface-emitting lasers to the one or more edge-receiving optical devices.

1 4. The method of claim 1, wherein the optical bench substrate defines one or more  
2 alignment features for aligning the laser substrate and the one or more edge-receiving optical  
3 devices together so as to optically couple the one or more surface-emitting lasers to the one or  
4 more edge-receiving optical devices.

1 5. The method of claim 2, wherein the slot is photolithographically fabricated in the optical  
2 bench substrate.

1 6. The method of claim 2, wherein the slot is fabricated in the optical bench substrate using  
2 electron beam lithography.

1 7. The method of claim 4, wherein the alignment features are photolithographically  
2 fabricated in the optical bench substrate.

1 8. The method of claim 4, wherein the alignment features are fabricated in the optical bench  
2 substrate using electron beam lithography.

1 9. The method of claim 2, wherein the step of mounting the laser substrate comprises the  
2 step of mounting the laser substrate to the slot on the optical bench substrate by one of solder and  
3 epoxy.

1 10. The method of claim 1, wherein the step of mounting the one or more edge-receiving  
2 optical devices comprises the step of mounting the one or more edge-receiving optical devices  
3 on the optical bench substrate by one of solder and epoxy.

1 11. The method of claim 1, wherein the step of mounting the one or more edge-receiving  
2 optical devices comprises the step of monolithically fabricating the one or more edge-receiving  
3 optical devices on the optical bench substrate.

1 12. The method of claim 1, wherein the one or more surface-emitting lasers comprise an  
2 array of lasers and the one or more edge-receiving optical devices comprise an array of edge-  
3 receiving optical devices.

1 13. The method of claim 1, wherein the one or more edge-receiving optical devices comprise  
2 one or more edge-receiving optical modulators.

1 14. The method of claim 1, wherein the one or more edge-receiving optical devices comprise  
2 one or more edge-receiving optical amplifiers.

1 15. The method of claim 13, wherein the one or more edge-receiving optical devices further  
2 comprise one or more edge-receiving optical amplifiers positioned in the path of the output  
3 signals from the one or more edge-receiving optical modulators.

1 16. The method of claim 14, wherein the one or more edge-receiving optical devices further  
2 comprise one or more edge-receiving optical modulators positioned in the path of the one or  
3 more output signals from the one or more edge-receiving optical amplifiers.

1 17. The method of claim 1, wherein the one or more edge-receiving optical devices are  
2 semiconductor optical amplifiers (SOAs).

1 18. The method of claim 1, wherein the one or more edge-receiving optical devices are  
2 optical waveguides.

1 19. The method of claim 1, wherein the one or more surface-emitting lasers are vertical-  
2 cavity surface-emitting lasers (VCSELs).

1 20. The method of claim 1, wherein the optical bench substrate further comprises, for each  
2 edge-receiving optical device, a driver circuit coupled to the edge-receiving optical device.

1 21. The method of claim 1, wherein the optical bench substrate is a silicon optical bench.

1 22. A method of conditioning the output signals of one or more surface-emitting lasers, the  
2 method comprising the steps of:

3 mounting the one or more surface-emitting lasers to an optical bench substrate having  
4 one or more edge-receiving optical devices so as to optically couple the one or more surface-  
5 emitting lasers to the one or more edge-receiving optical devices; and

6 coupling the output signals to the one or more edge-receiving optical devices.

1 23. The method of claim 22, wherein the one or more surface-emitting lasers are fabricated  
2 on a laser substrate; and wherein the step of mounting the one or more surface-emitting lasers  
3 comprises the step of mounting the laser substrate to a slot on the optical bench substrate so as to  
4 optically couple the one or more surface-emitting lasers to the one or more edge-receiving  
5 optical devices.

1 24. The method of claim 23, wherein the step of mounting the laser substrate comprises the  
2 step of mounting an edge of the laser substrate to the slot so as to optically couple the one or  
3 more surface-emitting lasers to the one or more edge-receiving optical devices.

1 25. The method of claim 22, wherein the step of mounting the one or more surface-emitting  
2 lasers comprises the step of mounting the one or more surface-emitting lasers to the optical  
3 bench substrate by one of solder and epoxy.

1 26. The method of claim 22, wherein the optical bench substrate defines one or more  
2 alignment features for aligning the laser substrate and the one or more edge-receiving optical  
3 devices together so as to optically couple the one or more surface-emitting lasers to the one or  
4 more edge-receiving optical devices.

1 27. The method of claim 22, wherein the one or more edge-receiving optical devices are  
2 monolithically fabricated on the optical bench substrate.

1 28. The method of claim 22, wherein the one or more edge-receiving optical devices  
2 comprise one or more edge-receiving optical modulators.

1 29. The method of claim 22, wherein the one or more edge-receiving optical devices  
2 comprise one or more edge-receiving optical amplifiers.

1 30. The method of claim 28, wherein the one or more edge-receiving optical devices further  
2 comprise one or more edge-receiving optical amplifiers positioned in the path of the output  
3 signals from the one or more edge-receiving optical modulators.

1 31. The method of claim 29, wherein the one or more edge-receiving optical devices further  
2 comprise one or more edge-receiving optical modulators positioned in the path of the output  
3 signals from the one or more edge-receiving optical amplifiers.

1 32. A method of assembling a surface-emitting laser system comprising the steps of:  
2 fabricating an array of surface-emitting lasers in a laser substrate;  
3 providing an optical bench substrate having an array of edge-receiving optical devices;  
4 and  
5 mounting the laser substrate on the optical bench substrate so as to optically couple the  
6 array of surface-emitting lasers to the array of edge-receiving optical devices.

1 33. The method of claim 32, wherein the step of providing an optical bench substrate  
2 comprises the step of fabricating a slot for receiving an edge of laser substrate.

1 34. The method of claim 33, wherein the step of providing an optical bench substrate further  
2 comprises fabricating alignment features for aligning the laser substrate and the array of edge-  
3 receiving optical devices together so as to optically couple the array of surface-emitting lasers to  
4 the array of edge-receiving optical devices.

1 35. A system for conditioning the output signals of one or more surface-emitting lasers, the  
2 system comprising:

3 an optical bench substrate;

4 the one or more surface-emitting lasers being mounted on the optical bench substrate;

5 and

6 one or more edge-receiving optical devices positioned on the optical bench substrate so  
7 as to receive the output signals from the one or more surface-emitting lasers.

1 36. The system of claim 35, wherein the one or more surface-emitting lasers are fabricated in  
2 a laser substrate, and wherein the optical bench substrate photolithographically defines a slot for  
3 receiving an edge of the laser substrate so as to optically couple the one or more surface-emitting  
4 lasers to the one or more edge-receiving optical devices.

1 37. The system of claim 36, wherein the optical bench substrate further photolithographically  
2 defines alignment features for aligning the laser substrate and the one or more edge-receiving  
3 optical devices together so as to optically couple the one or more surface-emitting lasers to the  
4 one or more edge-receiving optical devices.

1 38. The system of claim 36, wherein the slot is fabricated in the optical bench substrate by  
2 electron beam lithography.

1 39. The system of claim 36, wherein the alignment features are fabricated in the optical  
2 bench substrate by electron beam lithography.

1 40. The system of claim 35, wherein the one or more edge-receiving optical devices are  
2 monolithically fabricated on the optical bench substrate.

1 41. The system of claim 35, wherein the optical bench substrate is a silicon optical bench.

1 42. The system of claim 35, wherein the system is for use in one of data communications and  
2 telecommunications.

1 43. The system of claim 35, wherein the system is further for measuring radiation absorption  
2 by a measurement species, the system further comprising:

3 one or more sources of single mode laser radiation comprising the one or more surface-  
4 emitting lasers, respectively; and

5 a detector for detecting the single mode laser radiation after passage thereof through a  
6 quantity of said measurement species.

1 44. The system of claim 43, wherein the laser radiation is infrared laser radiation.

1 45. The system of claim 43, wherein the measurement species is a gas disposed in a  
2 measurement cell.

1 46. The system of claim 43, wherein the measurement species is an unconfined gas.

1 47. The system of claim 43, wherein the measurement species is one or more of human  
2 blood, a bacterial species, and a viral species.